November 9, 2000

Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, SW
TW-A325
Washington, DC 20554

Re: **STPCS Joint Venture, LLC d/b/a SOL Communications**
Enhanced 911 Phase II Location Technology Report
CC Docket No. 94-102

Dear Ms. Roman Salas:

Attached for filing with the Federal Communications Commission, pursuant to Section 20.18(i) of the Commission's Rules, 47 C.F.R. § 20.18(i), is the Report of STPCS Joint Venture, LLC d/b/a SOL Communications ("STPCS"), setting forth its current plans for implementation of Phase II Enhanced 911 service ("E911").

STPCS makes this filing on behalf of its wholly-owned subsidiaries STPCS F Block, LLP and STPCS D Block, LLP.

Any questions concerning this filing should be directed to the undersigned.

Sincerely,

Julia K. Tanner
General Counsel

Attachment

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STPCS Joint Venture, LLC

E911 Phase II
Location Technology Report

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Introduction

STPCS Joint Venture, LLC d/b/a SOL Communications is a small business provider of personal communications services in the South Texas markets of Brownsville-Harlingen (BTA 056), Corpus Christi (BTA 099), Eagle Pass-Del Rio (BTA 121), Laredo (BTA 242), McAllen (BTA 268), and Victoria (BTA 456). Collectively, STPCS Joint Venture, LLC, its wholly-owned subsidiaries STPCS F Block, LLP and STPCS D Block, LLP, and any successors-in-interest to the extent applicable, are hereinafter referenced as "STPCS."

The STPCS wireless communications system utilizes GSM technology, relying upon a Nokia Mobile Switching Center ("MSC") and Nokia Base Tranceiver Stations. This document sets forth the strategy for implementation of Phase II E-911 within the STPCS system.

As the Commission is aware, STPCS has filed applications for assignment of all of its licenses to VoiceStream Wireless Corporation and VoiceStream PCS BTA I Corporation (collectively, "VoiceStream") and Cook Inlet / VS GSM IV PCS, LLC. These entities have executed definitive documents for purchase of substantially all of the assets of STPCS. As an aspect of a smooth transition, in the event the assignment applications are granted, STPCS intends for its Phase II solution to integrate with the VoiceStream solution for Phase II as well as with waivers granted to VoiceStream. The Commission will note that much of the solution discussed herein accordingly corresponds with the VoiceStream solution also filed upon the date hereof.

Background / Contact Information

(1) Carrier Identifying Information:

STPCS Joint Venture, LLC d/b/a SOL Communications (TRS Number 819070), makes this filing as the parent company of its license-holding subsidiaries STPCS D Block, LLP (TRS Number 819068) and STPCS F Block, LLP (TRS Number 819062).

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References

[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.71: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Service description; Stage 1".

[3] GSM 03.07: "Digital cellular telecommunications system (Phase 2+); Restoration Procedures".

[4] GSM 03.41: "Digital cellular telecommunication system (Phase 2+); Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[5] GSM 03.49: "Digital cellular telecommunication system (Phase 2+); Example protocol stacks for interconnecting Cell Broadcast Centre (CBC) and Mobile-services Switching Centre (MSC)".

[6] GSM 03.78: "Digital cellular telecommunications system (Phase 2+); Customized Application for Mobile network Enhanced Logic (CAMEL) Phase 3; Stage 3".

[6a] GSM 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[7] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[8] GSM 04.31: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Mobile Station (MS) – Serving Mobile Location Center (SMLC); Radio Resource LCS Protocol (RRLP)".

[9] GSM 04.71: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 Location Services (LCS) specification".

[10] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre – Base Station System (MSC-BSS) interface; Layer 3 specification".

[11] GSM 08.31: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Serving Mobile Location Center (SMLC) – Serving Mobile Location Center (SMLC); SMLC Peer Protocol (SMLCPP)".

[11a] GSM 08.58: "Digital cellular telecommunications system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".

[12] GSM 08.71: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Serving Mobile Location Center – Base Station Subsystem (SMLC-BSS) interface Layer 3 specification".

[13] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[14] GSM 09.31: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Base Station System Application Part LCS Extension (BSSAP-LE)".

[15] CCITT Recommendations I.130: "General modelling methods – Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[16] CCITT Recommendation Q.65: "Methodology – Stage 2 of the method for the characterization of services supported by an ISDN".

[17] GSM 03.71: version 8.0.0 Release 1999;Digital cellular telecommunications system (Phase 2+) Location Services (LCS);(Functional description)

Definitions of Terms

MSC	*Mobile Switching Center*
BSC	*Base Station Controller*
BTS	*Base Transceiver Station*
TCU	*Transcoder Units*
SMLC	*Serving Mobile Location Center*
GMLC	*Gateway Mobile Location Center*

1 Type of Technology: Description of NSS and E-OTD

STPCS expects that the Phase II technologies it has selected will be furnished by the manufacturer of its mobile switching center, Nokia Networks Inc., a subsidiary of Nokia Oyj. These same technologies will be deployed in all STPCS markets, as identified in the Introduction.

1.1 Network Software Solution (NSS)

A new node, the Mobile Location Center (MLC), will be implemented by STPCS in order to provide the basic NSS solution for the STPCS system. This new node will be divided into two functional blocks: the Serving Mobile Location Center (SLMC) and the Gateway Mobile Locating Center (GLMC).

The SMLC provides the location calculation point, schedules the position calculation and interfaces with the GSM radio switching network via optional connections to either the MSC or BSC. The GMLC is the interface to the external LCS clients and will be the interface to the PSAP. In the initial deployment the SLMC and GLMC may be implemented as a combined node. Figure 1 depicts the reference architecture that STPCS will follow.

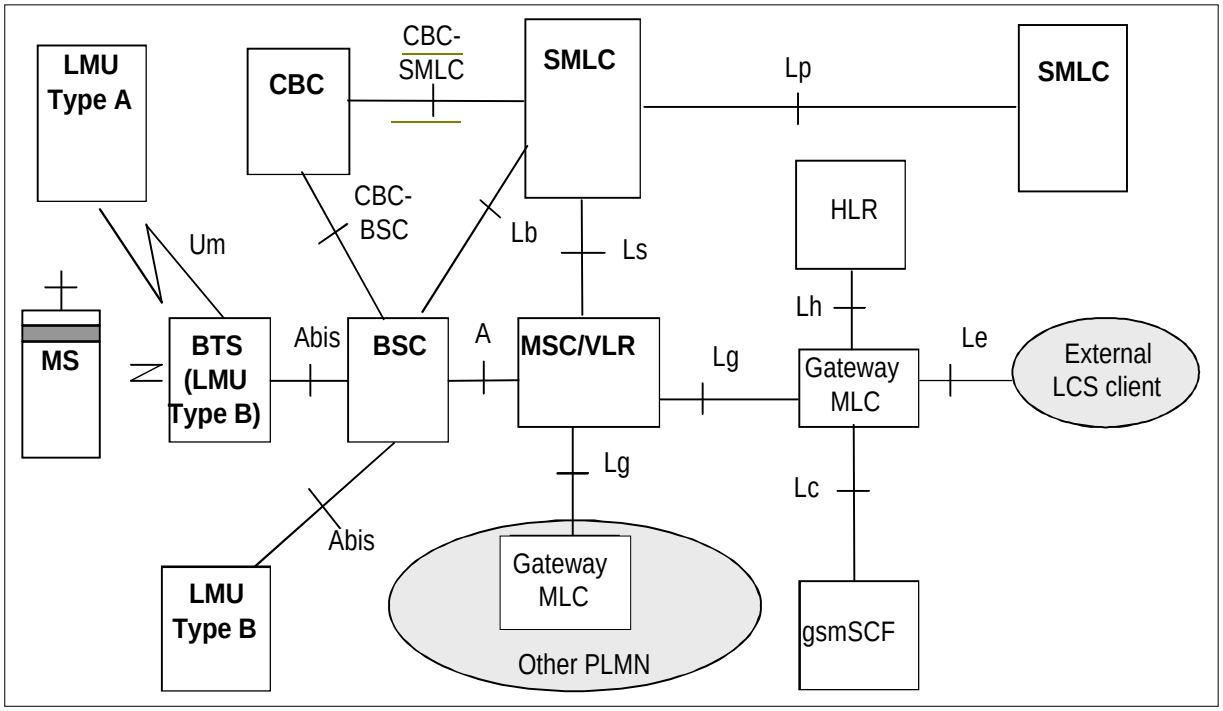


Figure 1: GSM Reference diagram - GSM 03.71

The GMLC/SMLC architecture and all relevant interfaces, call messaging, signalling protocols and interworking functions have been specified by the GSM standards bodies (T1.P1 and ETSI). All interfaces are specified in the following GSM documents for reference:

GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile-services Switching Centre – Base Station System (MSC-BSS) interface; Layer 3 specification".

GSM 08.31: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Serving Mobile Location Center (SMLC) – Serving Mobile Location Center (SMLC); SMLC Peer Protocol (SMLCPP)".

GSM 08.58: "Digital cellular telecommunications system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".

GSM 08.71: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Serving Mobile Location Center – Base Station Subsystem (SMLC-BSS) interface Layer 3 specification".

GSM 03.71: “Digital cellular telecommunications system (Phase 2+);Location Services (LCS); (Functional description) - Stage 2”

GSM specification 03.71 also describes in detail the functionality of each node and also the message sequencing that is needed to support LCS.

STPCS will implement a GMLC and SMLC based infrastructure in accordance with the GSM standards approved for Release 99 (R99).

STPCS intends to deploy a solution that meets current and forecasted demands for E911 service for its system, both on a stand-alone basis and as integrated into the VoiceStream system. VoiceStream’s vendors (one of which is also Nokia) offer a combined GLMC/SLMC node of varying processing power ranging from 10 Transactions per second (tps) to 200tps for support of NSS. Studies have been carried out for Nokia’s DX200 platform resulting in recommendations for two nodes of 20 tps capacity.

Initial studies of E911 call handling capabilities, performed for STPCS’s GSM colleague, VoiceStream, are described in detail in the VoiceStream pleading in this matter, submitted on the date hereof. As described therein, this deployment model, which is also being adopted by STPCS, provides more than ample E911 capacity and is deliberately generous in order to avoid the possibility of failing to have sufficient call processing capacity to meet E911requirements.

Interconnection between the nodes and to the network MSC will be accomplished via the STPCS internal asynchronous transfer mode (ATM) network, a totally meshed network of 99.999% reliability. Interconnection to the PSAPs will be accomplished via leased T1 lines.

1.1.1 Summary of Network Software Solution

- STPCS is working with Nokia to develop and deploy the NSS throughout its network by the FCC implementation date of December 31, 2001.

- The NSS requires no handset modifications and needs the addition of only one new node in the network. Therefore, the NSS can be used as the Location Finding System for existing subscribers and roamers although it is less accurate than the other methods employed. Fully supports legacy handsets.

- Uses Cell ID, BTS calculated Timing Advance and optionally signal strength data currently collected by the handset to improve the accuracy of the position estimate.

- Will provide increased accuracy over Phase I alone (cell ID) – 1000 meters, 67 percent of calls.

- Can generate an improved accuracy result (over Phase I) even if the mobile can receive only one cell site. Accuracy improves if additional cell sites can be received.

- Can be deployed sooner than E-OTD or Assisted GPS (A-GPS) technologies can be deployed for GSM customers in the U.S. (by December 31, 2001).

- Can continue to be used as a fallback location method for non-ALI capable handsets or extreme environments, even after more accurate location technologies (such as E-OTD, UL-TOA or A-GPS) have been deployed.

1.1.2 Location of Non-Compatible Handsets:

Locating legacy handsets is of particular importance in any handset-based ALI technology, including E-OTD. STPCS proposes to adopt the NSS "Safety Net" as espoused by VoiceStream in order to provide a level of legacy support to all STPCS subscribers and roaming customers, regardless of handset type. The accuracy of the NSS solution is higher than that available in E911 Phase I (cell ID). The NSS solution also creates a more accurate backup solution to instances where the E-OTD system may not be able to perform a location measurement.

The NSS solution focuses upon using standard information available in the network collected by the BSS (Base Station Subsystem) which is made available to the location system. The accuracy of this system was specified in the Commission's Fourth Order on E911, section 61 "*This technology must provide location information with an accuracy and reliability of 1000m, or better, for 67 percent of calls.*" In light of VoiceStream simulation results, STPCS believes this

level of accuracy is achievable. The following items are to be used by the NSS algorithm:

- Cell Identifier
- Timing Advance
- Received Signal Strength Information
- Base Station Locations
- Base Station Channel Numbers
- Base Station Identity Codes

The Cell Identifier indicates the serving cell of the MS – the same information that is passed to PSAPs in E911 Phase I. Timing Advance (TA) provides information to the MS to allow timeslot synchronization at the BTS. These measurements have inherent inaccuracies. The GSM standard specifies tolerances for TA. For MS timing, GSM 05.10 [1] sections 6.2 and 6.3 specify that the MS timing shall be +/-0.5 bit. GSM 05.10 section 6.4 specifies that the transmit timing error tolerance, when measured at the MS antenna, shall be +/-1 bit period.

For the BSS timing, GSM 05.10 section 5.3 specifies that synchronization between carriers shall be less than 1/4 bit period. GSM 05.10 section 5.6.1 specifies that "if the delay changes by more than one bit period, the timing advance shall be advanced or retarded by 1 and the new value signaled to the MS." This "signaling tolerance" is not part of the TA error source as long as the BSS keeps track of it. GSM 05.10 section 5.6.3 specifies that "the delay assessment error is less than 1/2 bit period for a stationary MS. For MS moving at a speed up to 500 km/hr, the additional error shall be less than 1/4 bit period.

Tests have been performed on the NSS method, using cell ID and Timing Advance only. The simulation model assumes a 5km inter-site distance for the suburban sites, a 1km inter-site distance for urban and 15 km for the rural environments. The model takes into account shadow fading and antenna patterns, and assumes a random distribution of mobiles.

These results are presented in Table 1.

Environment	Cell Radius	67% Percentile	95% Percentile
Urban	1000m	200m	450m
Suburban	5000m	1000m	2100m
Rural	15000m	3000m	6400m

Table 1: STPCS Cell ID & TA Simulation Results

These simulation results show that for urban and suburban environments the 1000m 67% accuracy requirement is met. Improvements in the measurement accuracy will be achieved by incorporating signal strength measurements.

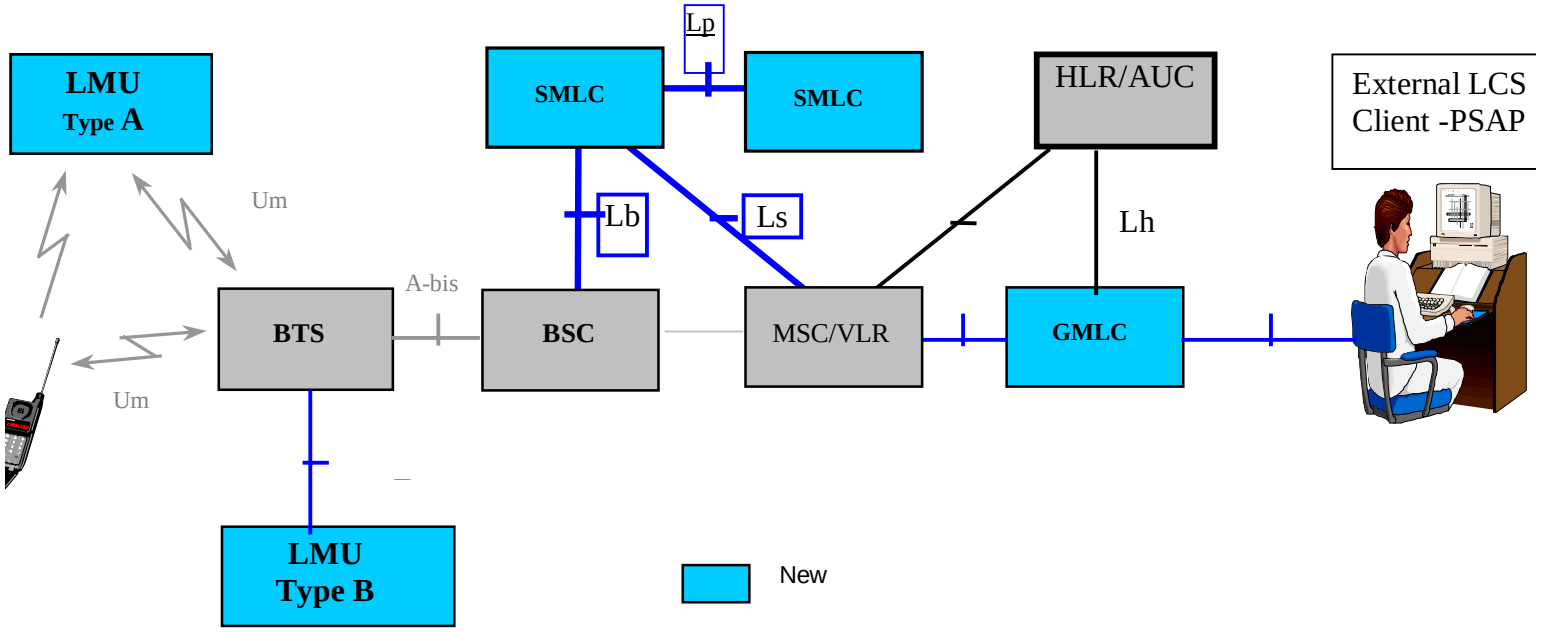
Tests have been performed by Xircom, formerly known as Omnipoint Technologies, to independently study the possible accuracies of software for the NSS solution. OTI used a form of Kalman filtering to estimate the basic NSS performance. Their simulation tool used network assumptions set forth in Table 2. Both simulations tend to show that the NSS solution should produce results better than the FCC-required 1000m accuracy in most environments.

Environment	Cell Radius	67% Percentile
Urban	1500m	470m
Suburban	2000m	475m
Rural	7000m	1560m

Table 2: OTI NSS Simulations

1.2 ENHANCED OBSERVED TIME DIFFERENCE (E-OTD)

1.2.1 Detailed Description of E-OTD taken from 03.71



Two types of Location Measurement Unit (LMU):

Type A -Transparent to BSS

Type B - Non-Transparent to BSS

Figure 2 : E-OTD Architecture

The E-OTD method is based upon measurements in the mobile station (MS) of the Enhanced Observed Time Difference of arrival of bursts of nearby pairs of Base Transceiver Stations (BTSs). For E-OTD measurement synchronization, normal and dummy bursts are used. When the transmission frames of BTSs are not synchronized, the network needs to measure the Relative or Absolute Time Differences (RTDs or ATDs) between them. To obtain accurate triangulation, E-OTD measurements and, for non-synchronized BTSs, RTD or ATD measurements are needed for at least three distinct pairs of geographically dispersed BTSs. Based on the measured E-OTD values, the location of MS can be calculated either in the network or in the MS itself, if all the needed information is available in MS.

The location estimate is performed by a Position Calculation Function (PCF) located in the MS or in the network (SMLC). With the same network architecture, MS functions, LMU functions and measurement inputs the PCF can be based on a hyperbolic or circular E-OTD location calculation.

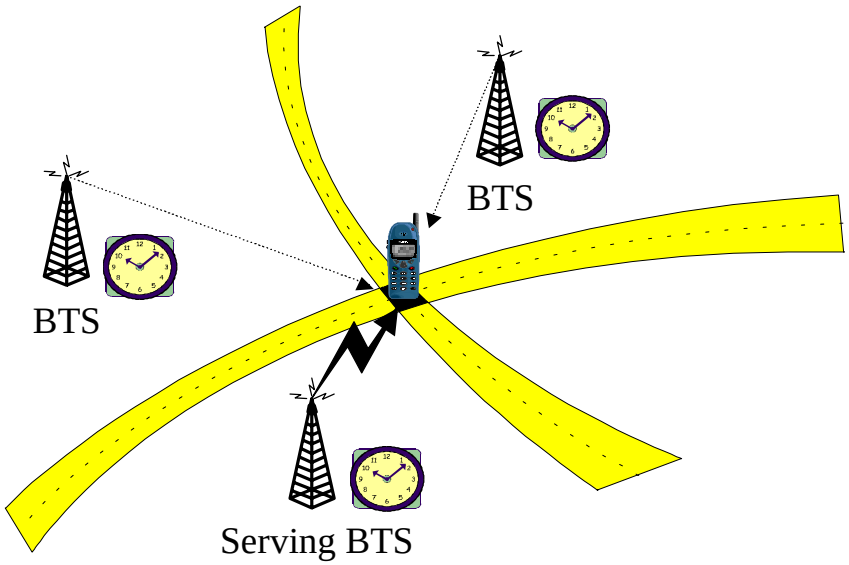


Figure 3: E-OTD Hyperbolic Measurement Method

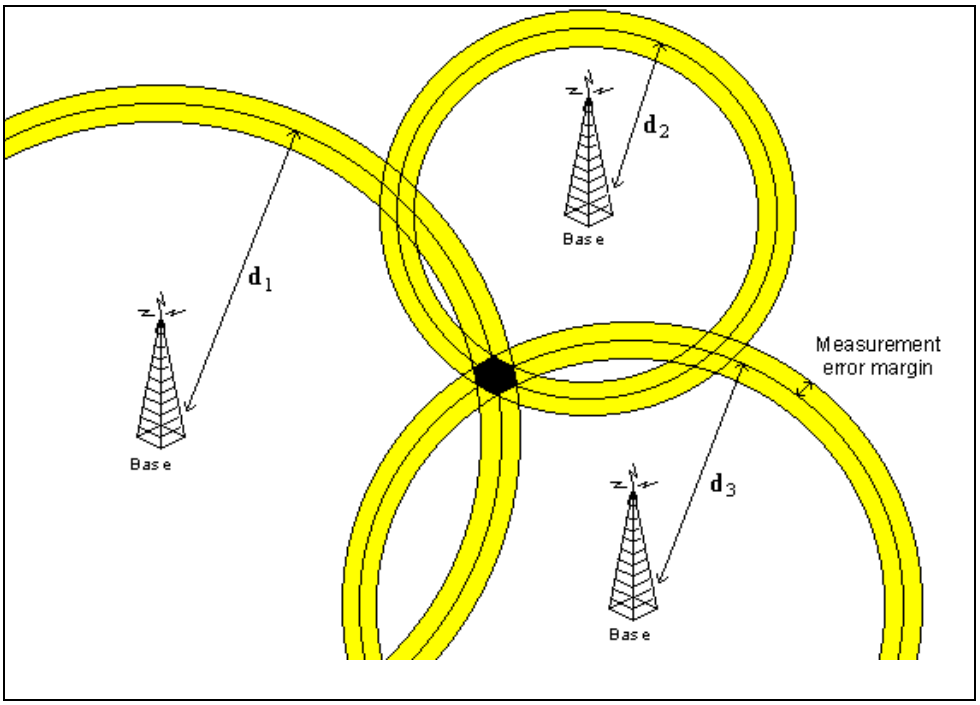


Figure 4: Circular Positioning Method

1.2.2 Summary of E-OTD Features

- E-OTD systems operate by placing location receivers or time referenced receivers, overlaid on the PCS network as a Location Measurement Unit (LMU) at multiple sites geographically dispersed in a wide area. Each of these receivers has an accurate timing source and when a signal from at least three base stations is received by the E-OTD software enabled mobile and several LMUs, the time differences of arrival of the signal from each BTS at the handset and the LMUs are calculated. The differences in calculated time differences are then combined to produce intersecting hyperbolic lines from which the location is estimated.

- E -OTD requires an external antenna at each site. The process of obtaining the necessary approvals for this antenna can take an extended period of time due to local zoning rules and planning ordinance.

- In the event additional sites will be needed to enhance the accuracy of the system, STPCS intends to add such sites in high 911 call areas, after the necessary approvals can be obtained.

- E -OTD is described in Annex C of GSM 03.71.

- NSS nodes, SMLC and GMLC can be software-upgraded to support E -OTD.

2 Testing and Verification

2.1 E-OTD Technology Trial

As the Commission is aware, VoiceStream, a PCS carrier that is also an investor in STPCS, has been participating in an ongoing E-OTD technology trial with Cambridge Positioning Systems, Ltd. (CPS) in Houston, TX. On August 11, 2000, Stage One of the trial was completed. The final results compare favorably with the FCC's accuracy requirements: 67 percent of the measurements taken were within 57 meters of the actual position (determined via differential GPS), 92 percent were within 100 meters, and 97.5 percent were within 150 meters. There was little difference between measurements made inside and outside vehicles. As a preliminary matter, therefore, it appears that E -OTD can performs well and can approach the FCC's E-911 accuracy requirements.

Stage Two of the trial was completed on October 9 - 10, 2000. The test area was increased to approximately 100 km^2. This increased the variety and type of measurement locations including areas of poor radio performance. Tests were carried out dedicated-mode which allowed positioning to occur while a call was in progress. The methodology outlined in the OET Document 71 was used for all Stage Two testing; test locations were randomly distributed and included both pedestrian and in building locations.

Measurement accuracy remained encouraging at 77m for 67% of calls. This reduction in accuracy from the Stage One results reflects the more varied test locations and the inclusion of in-building measurements and poor radio locations.

Analysis of the individual test mobile performance has shown marked variation in accuracy between similar mobiles. Analysis has revealed that changes to the GSM recommendations and improved mobile design should be able to reduce this variation.

2.2 STPCS Testing and Verification

This section is intended to describe how E911 Phase II compliance testing will be conducted within the STPCS markets. The methodology is based upon OET Bulletin 71, "*Guidelines for Testing and Verifying the Accuracy of Wireless E911 Location Systems,*" as proposed by the FCC on April 12, 2000.

The OET 71 guidelines detail two main methods of compliance verification: empirical testing in a live market and modeling of specific ALI technologies using an industry acceptable model which is an accurate representation of the technology independent of the operating areas in which it may reside.

STPCS is not aware of a suitable computer model that is accurate for E-OTD type systems. In the future, should such a model be developed which can perform this function in multiple geographical areas, STPCS may decide to pursue this method of testing in the interest of time and resources. There is a likelihood, however, that the NSS "Safety Net" solution may be proven by a predictive method as it is considerably less complex. STPCS's colleague VoiceStream is currently investigating predictive methods to determine the accuracy of the NSS in different environments and such methods will be correlated against known drive test data to verify the accuracy of the prediction. Should the predictive methods prove unreliable, empirical methods can be used to verify E911 accuracy compliance.

To verify the accuracy of E -OTD, therefore, STPCS will use empirical drive test methods until suitable modeling methods are available.

The OET Bulletin 71 guidelines state, "Accuracy tests may be based on the local coverage areas of PSAPs that request Phase II locating information." NENA has proposed defining the test area as the entire coverage area of a market/metropolitan area. The determination of this test area will be based upon a number of factors including the deployment schedule, testing schedule, E911 call distribution, and the size of the PSAP coverage area relative to the service area where STPCS provides commercial service. No test area will include areas where STPCS service is not available. If an STPCS market service area is served by multiple PSAPs, the test area at minimum will include the PSAP(s) which have requested Phase II information. In this instance the test area may be as large as the entire market service area if STPCS has completed installation and commissioning of all necessary ALI equipment. If the compliance testing is chosen to be performed by PSAP area, the individual PSAP testing areas will not overlap.

Once the test area is defined, the next step for the empirical test will be distribution of test locations throughout the testing area. In the OET Bulletin 71 guidelines, the FCC "states a preference for using data on wireless 911 call location information, if available." Traffic statistics will show the number of 911 calls made in each cell in each market for a particular period of time. By bounding the urban, suburban, and rural areas of a market and using the call statistics, STPCS will be able to determine what percentage of 911 calls in a particular market area originate from urban, suburban, and rural areas.

STPCS intends to use such information to provide an accurate interpretation of ALI accuracy. The test locations should be distributed across urban, suburban, and rural areas such that that they correlate to actual wireless 911 call distribution. Test locations will be randomly chosen following uniform distribution within a geographic morphology (i.e., urban or rural).

The actual testing procedure will follow the following recommendations included in OET Bulletin 71:

- Testing will be performed using actual commercially available subscriber equipment
- Where Phase II location information is not available, Phase I data will be returned if it has been implemented by the PSAP
- Only completed 911 calls will be included in the accuracy statistics
- First location fix available within the first 5 seconds of the call (not necessarily used in statistics)
- Multiple location fixes within the first 30 seconds of the call (used in statistics)
- Location measurements shall be performed while the mobile is stationary as no suitable method has been developed for verifying accuracy while the mobile is moving
- Mobiles shall be in idle (ON-no call) mode at the location for 15 minutes prior to 911 call initiation
- Differential GPS (DGPS) shall be used as the reference location for accuracy calculation
- A vertical dimension will not be included in the Phase II information (Latitude, Longitude Only)
- Test calls will be made by a technician in normal fashion (ie next to head) and be made from in-vehicle where available
- Inaccessible randomly generated test locations shall be moved to the closest accessible area no more than 3 meters from the inaccessible boundary.
- Results will be analyzed as a whole, including in-car, indoor, and outdoor measurements
- Testing will be performed biannually

STPCS will provide updates on the testing procedure and methodology in good faith as changes arise. Any changes will be communicated to the Commission within thirty days of adoption.

3 Implementation Details And Schedule

Current estimates of software and hardware delivery times are set forth in Table 3. STPCS and Nokia are working diligently to shorten these preliminary timeframes.

Nokia has confirmed that it will have products available incorporating an E -OTD location solution by 3Q, 2001. Nokia's NSS solution should be available not later than Q4, 2001. The LMU hardware should be available in the beginning of Q4, 2001. Once the LMU hardware is available, network deployment and tuning can

commence. STPCS anticipates that it will take not more than 90 days to install and commission E-OTD equipment in the STPCS system. Based upon this estimated deployment period, E-OTD-based positioning will be available by the end of Q4, 2001. STPCS anticipates that the Q4, 2001 deployment may be only partial, with full-scale deployment available by Q1, 2002.

Assuming that only a limited number of PSAPs will be technically capable of accepting Phase II positional information in keeping with this timeframe, the availability of LMU and the time needed to deploy in the field should work well within the STPCS markets. However, if the number and scale of the deployments are larger than expected, there may be a risk of delays in deployment.

NSS SW	Q4	2001
EOTD SW	Q4	2001
LMU HW	Q4	2001
AGPS Infrastructure	Q4	2002

Table 3 : Delivery Schedule

STPCS is actively negotiating with its handset vendors in order to achieve the capability of complying with the Commission's handset deployment goals. STPCS believes these negotiations will conclude in a manner that will permit it to meet the deployment goals.

4 PSAP Interface

STPCS will not need to implement any changes specifically in order to be capable of transmitting Phase II data to the PSAPs, since it is using enhanced MF as standardized for 9-1-1. This also should obviate the need for any PSAP changes if the Phase I solution in place can migrate to Phase II.

STPCS will work with any third party NCAS provider supplied by the PSAPs and will make best efforts to make that solution work. STPCS is willing to provide information required from its own switch, but it continues to believe the expenses of obtaining and deploying third party NCAS hardware and obtaining certain third party database information should be borne by the requesting PSAPs or related entities. These significant expenditures are designed to fulfill public safety goals of the PSAPs and associated governmental organizations. Imposition of these expenditures upon private industry should be accomplished, if at all, explicitly through taxing mechanisms.

5 Existing Handsets

See discussions in Sections 1.1.2 and 3. STPCS intends to ensure that not less than 50 percent of all new handsets activated will be E-OTD capable by October 1, 2001, and that 100 percent of all new handsets activated will be E-OTD capable by March 31, 2002. STPCS also intends to comply with all applicable FCC deadlines and requirements relating to ALI accuracy. Finally, STPCS intends to ensure 95 percent penetration of location-capable handsets among its subscribers by December 31, 2005.

6 Location of Non-Compatible Handsets

See discussions in Sections 1.1.2 and 3.

7 Other Information

STPCS has not received any Phase II requests to date.